application bulletin

FLUKE®

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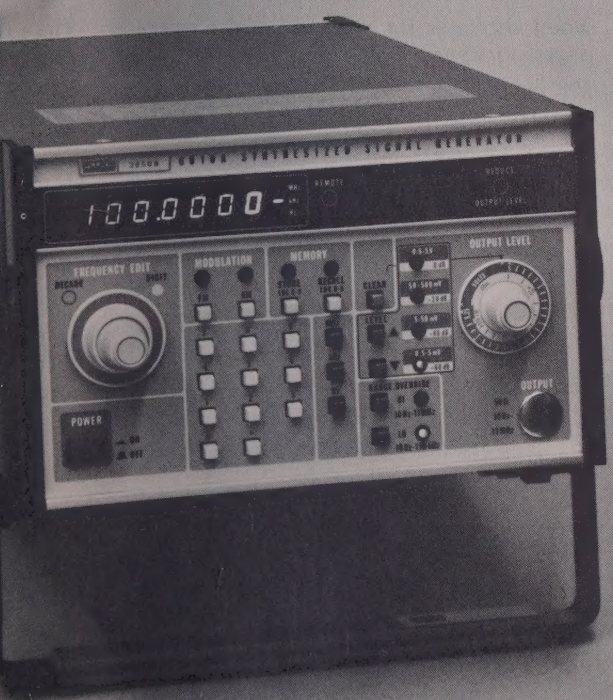
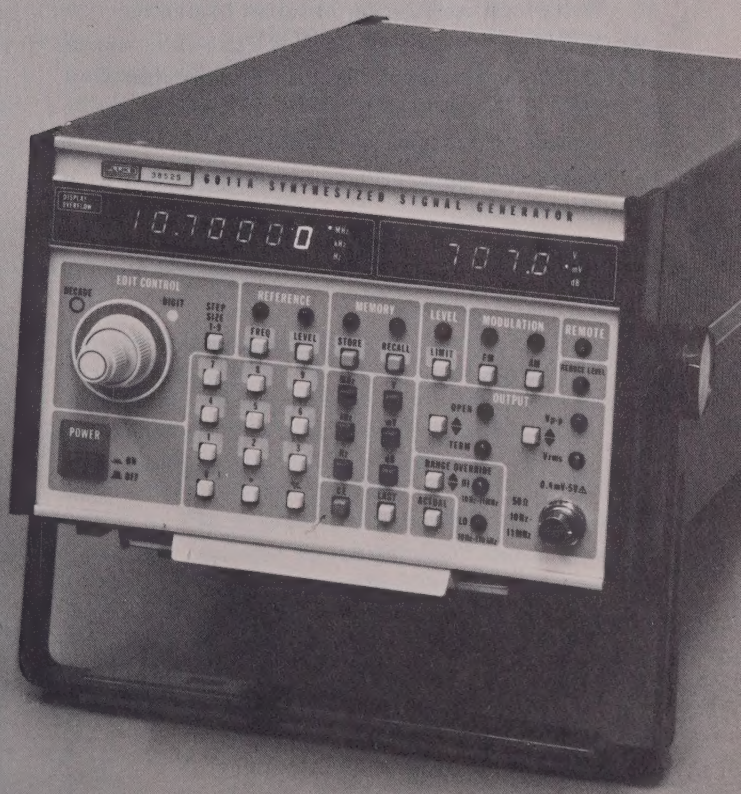
MODELS 6010A & 6011A SIGNAL GENERATORS





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INTRODUCTION

This booklet presents a sample of the many applications possible for the 6010A and 6011A Synthesized Signal Generators. Each of the applications included represents an actual use of the instrument by a Fluke customer. Please note that the high accuracy and stability of the 6010A and 6011A are a requirement in almost every example. In addition, the programmability features have found wide usage in production test environments where labor saving is a prime concern.

For more information about these applications or about other possible applications, please contact the Time and Frequency Applications Engineering Group at (206) 774-2507.

APPLICATION NOTE NUMBER 1

Reference signal source for driving HP 3570A Network Analyzer.

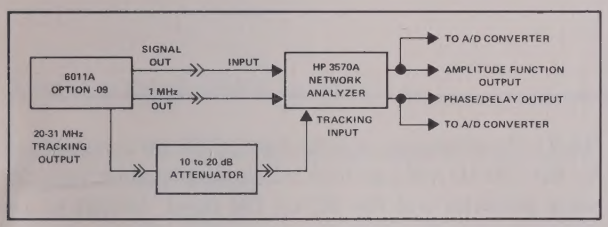

Figure 1

The 6011A with -09 option makes an ideal source for driving the HP 3570A. Some notes on this application are as follows (see block diagram):

(1) The 6011A must have -09 option (20-31 MHz Tracking Output). This signal must be attenuated by 10 to 20 dB before connecting it to the Tracking Input of the network analyzer.

(2) The 1 MHz Reference Output from the 6011A should be connected directly to the 1 MHz Input of the analyzer.

(3) The 6011A must be used in the high range only so that the tracking output will be correct. Remember that the 6011A automatically selects the low range for frequencies below 110 kHz. For these frequencies use the range override switch to place the 6011A back into the high range.

Several customers are now using the 6011A in this application. Main reason for purchase has been cost savings (the 6011A is several thousand dollars lower in cost than the comparable HP signal source).

APPLICATION NOTE NUMBER 2

Test and calibration of conductivity, temperature and depth measuring system used in oceanographic research.

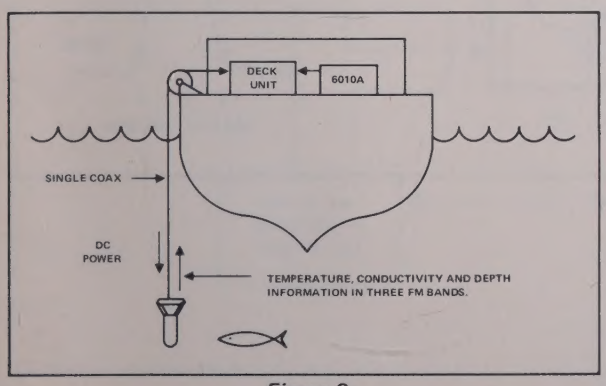

Figure 2

Current oceanographic research involves measuring temperature and conductivity of various ocean depths. Tests are made by a transducer attached to the end of a long cable which is lowered from the deck of a research vessel. Electrical connection is made by a single coax. The transducer accepts DC power from the deck unit and transmits information by FM in three bands. The deck readout units are tested and calibrated by substituting a known frequency from the 6010A for the transducer input. Precise frequency accuracy and ease of programming are important features of the 6010 in this application.

APPLICATION NOTE NUMBER 3

Calibration of variable time base counters used in jet engine testing.

The 6010A is currently being used to calibrate variable time base counters used in jet engine test cells. The engines, turning at various rpms, are coupled to the counters by magnetic pick ups. By varing the time base, a "k" factor is introduced to cause the readout to indicate fuel lbs/hr usage, The 6010 is also used as a source to simulate test cell engine output.

APPLICATION NOTE NUMBER 4

Production testing of filters with X - Y display.

This application requires a visual display of the frequency response of a high Q filter. The ramp generator simultaneously drives the FM input of the 6011A and the X input of the X - Y oscilloscope. A noise floor of -80 dB is maintained by the 100 Hz low pass filter which was added between the ramp generator and the 6011A FM input. Output of the 6011A is set to the center frequency of the filter under test. Ease of programming and frequency stability are important features of the 6011A in this application.

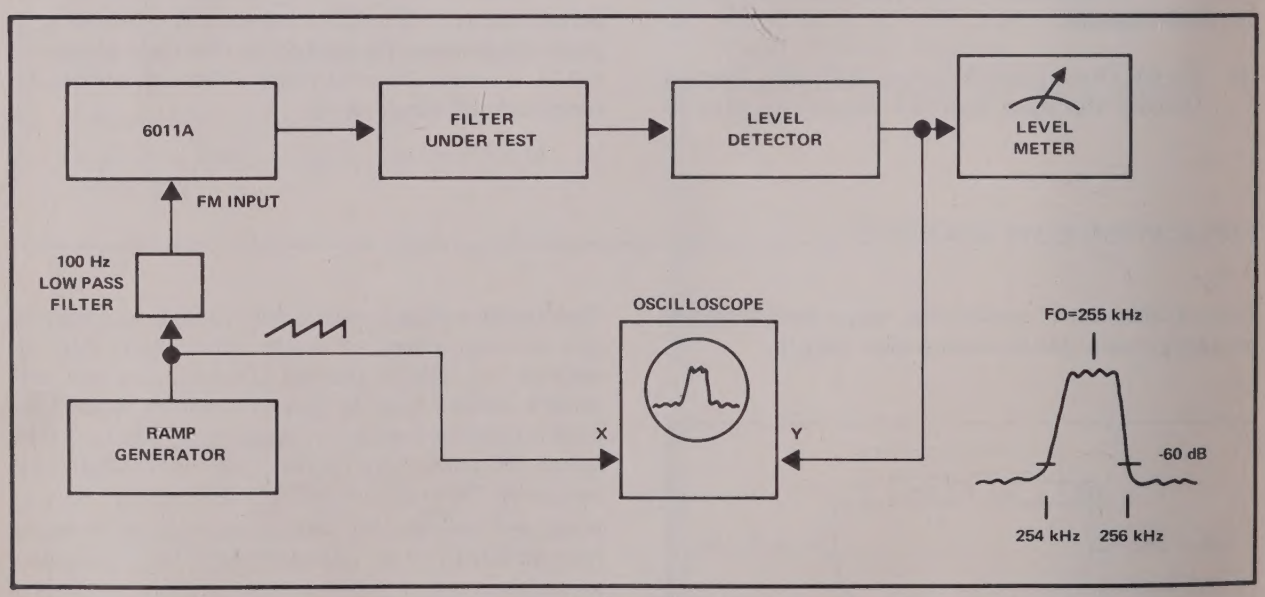

Figure 3

APPLICATION NOTE NUMBER 5

Production testing of aircraft automatic direction finder radios.

The 6011A is used as an RF source for checking RF sensitivity, signal to noise ratio, and direction finding accuracy of commercial airline and private aviation ADF receivers. Tests are made in broadcast band 540 - 1600 kHz. Receiver sensitivity is checked with both antennas parallel to each other. The transmitting antenna is then rotated to various calibrated positions to check receiver heading indications.

Programmable level is an important feature of 6011A in this application.

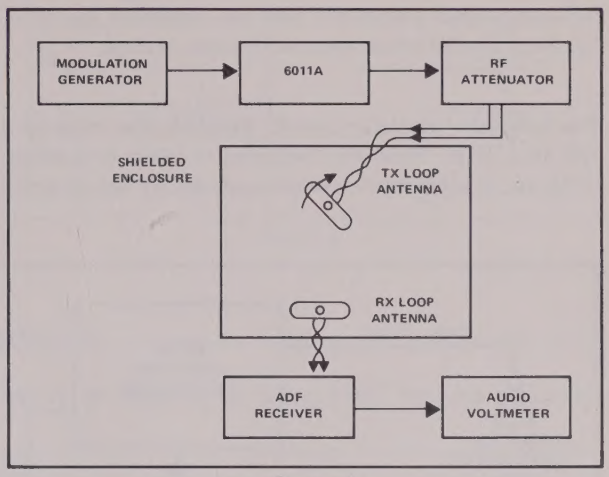

Figure 4

APPLICATION NOTE NUMBER 6

Signal source for measuring nuclear magnetic resonance of helium 3 at .002° Kelvin.

The 6010 is programmed for ten different predetermined center frequencies between 100 kHz and 10 MHz. These frequencies correspond to magnetic field intensities of 50 to 5000 gauss. The fine resonance lines are located by using a 400 Hz FM signal to sweep either side of the programmed center frequencies.

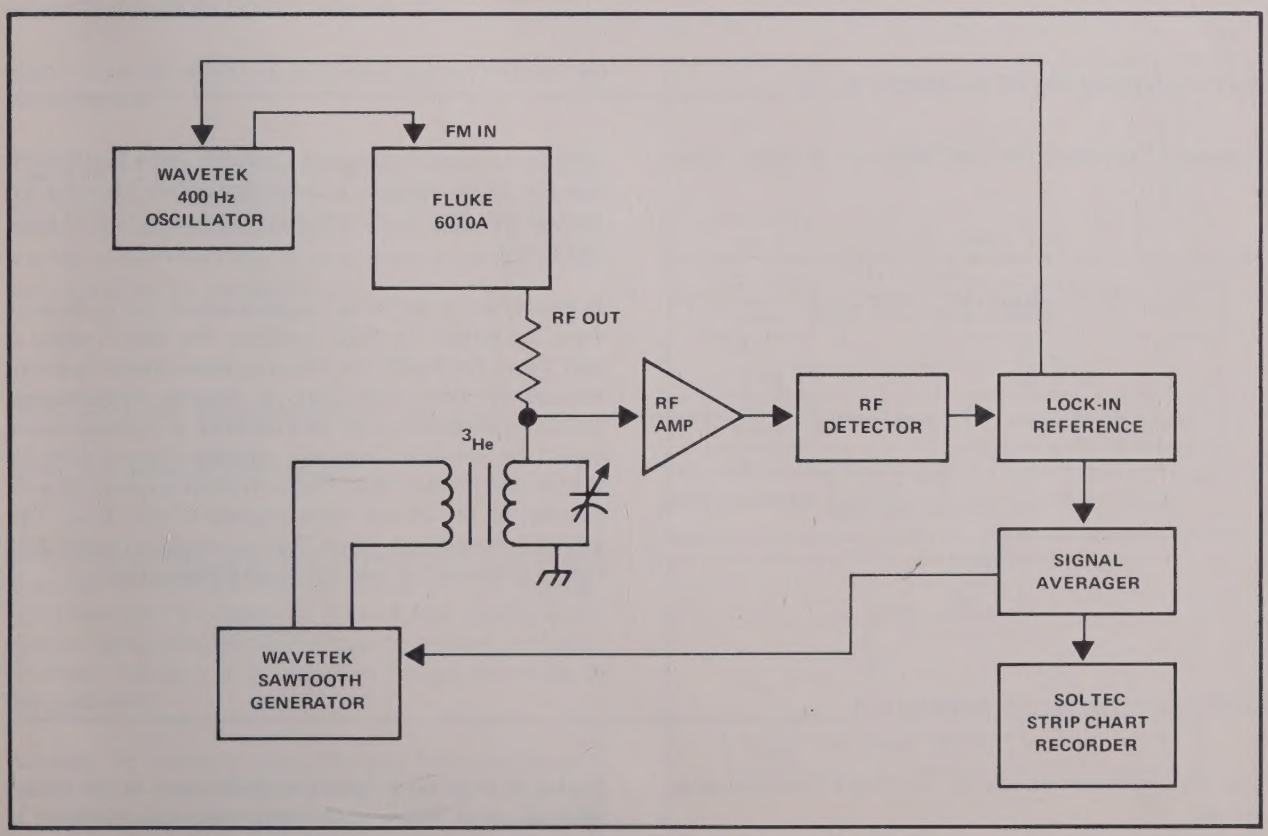

Figure 5

APPLICATION NOTE NUMBER 7

Reference signal source for Spectral Dynamics spectrum translator used in nondestructive vibration testing.

The Spectrum translator accepts signals in the range of 2 kHz to 1 MHz. These are translated to lower frequencies (2 Hz to 50 kHz) which can be processed by the dynamic analyzer. Plot on readout shows vibration amplitude response versus frequency.

Requirements for the reference input include precise frequency stability and setability, low phase noise and good spectral purity. The 6010 meets all requirements nicely.

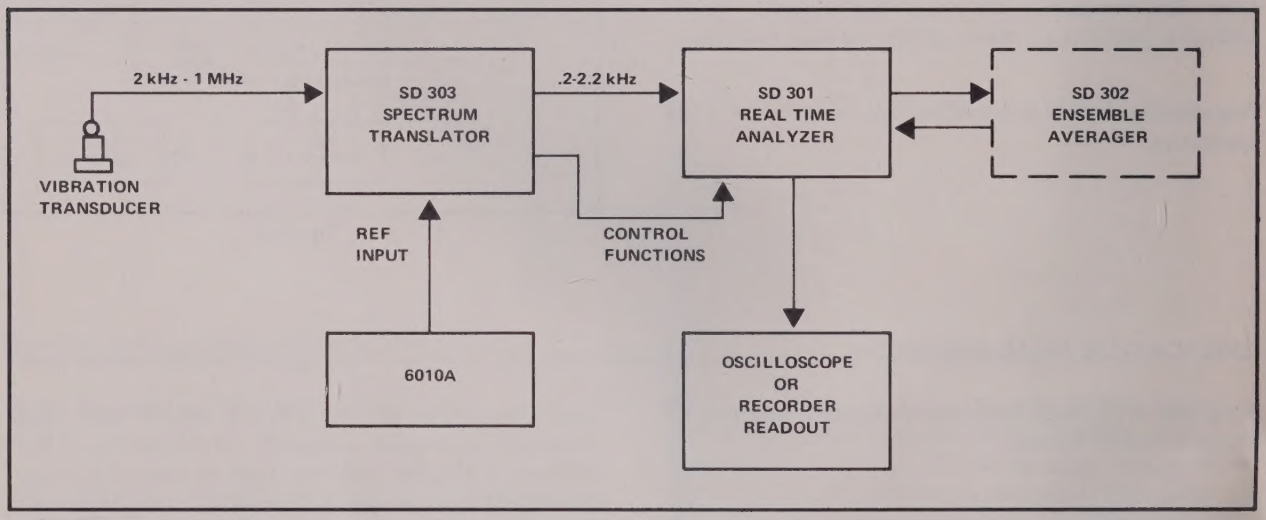

Figure 6

APPLICATION NOTE NUMBER 8

Computer controlled test and alignment of active filters.

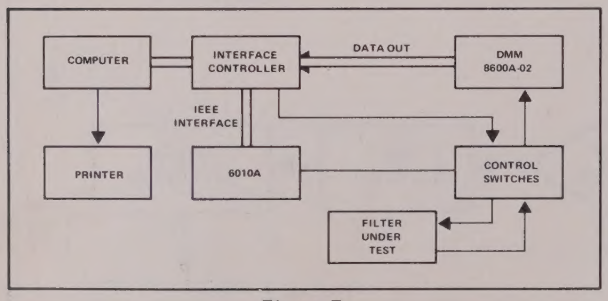

Figure 7

Initial production requirement involves 6 - pole Butterworth low pass filters designed as anti-aliasing filters for industrial control data lines from transducers to process control minicomputers.

In the test setup, the Wang computer selects test frequencies from the 6010A via IEEE interface. The 6010A signal is first fed to the 8600A for reference measurement and then through the filter under test for response measurement. Relative measurements are thus obtained to eliminate errors caused by absolute frequency response characteristics of 6010A and 8600A. The Wang computes response to a resolution of .01 dB and prints response of each filter. The program includes go, no-go limits so as not to waste time testing a filter whose response exceeds design limits.

APPLICATION NOTE NUMBER 9

Test and validation of remote microwave communication system.

The 6011A is used as a signal source at the central station to step through the various frequencies used in the system (300 Hz to 2 MHz). These frequencies are monitored at remote sites to determine amplitude loss.

A technician at a remote relay station calls the central facility to initiate testing of the various multiplexed channels. The 6011A is used as a signal source of specific amplitude to generate the required frequency from the central site. Both memory and level limit are utilized. Editing is often used for frequency response measurement.

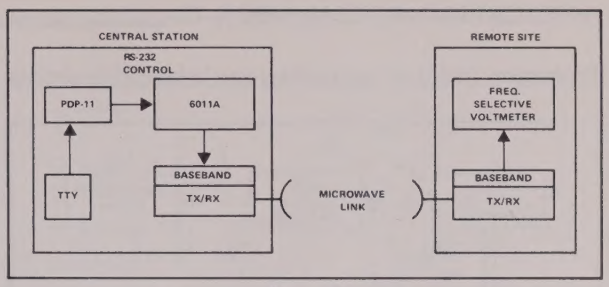

Figure 8

APPLICATION NOTE NUMBER 10

Stable local oscillator for broadcast transmitter in broadcast band 540 to 1600 kHz.

6010As are used in mobile vans containing broadcast transmitters. Output of the 6010A feeds a mixer prior to the power amplifier. The required L.O. frequency is stored in memory to facilitate speedy operation of backup transmitter or changes between day and night frequency assignments. 6010As allow the transmitters to change frequency assignments quickly when moved from one location to another.

Without the 6010, a large variety of crystals plus spares would be required at each possible assigned frequency.

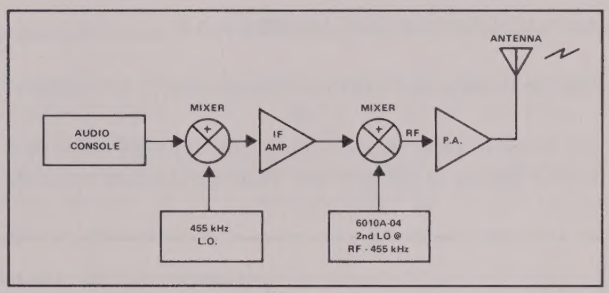

Figure 9

APPLICATION NOTE NUMBER 11

Signal source for repair and calibration of plant (vegetation) thermometers.

Very sensitive thermometers are used by NASA to measure the temperature of plant life. The transducer in the thermometers is a temperature-to-frequency converter. The 6010A provides a very stable step frequency source needed to calibrate and repair the readout circuits.

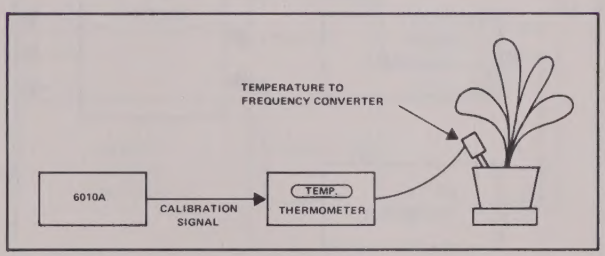

Figure 10

APPLICATION NOTE NUMBER 12

Production testing of active filters.

Setup shown is used to measure frequency response, Q, and phase lag of active filters in the 500 Hz to 20 kHz range. Key frequencies are stored in memory and recalled in sequence. Phase meter and RMS voltmeter readings are noted. Frequency accuracy is an important feature of 6011A in this application.

Presently the testing is done manually but soon the procedure will be computerized with the 6011A under control of a PDP-11 via RS 232C interface. Once a test of a link is initiated, the PDP-11 will supply frequency and amplitude information to the 6011A for transmission. Frequency stepping will be automatic under computer control.

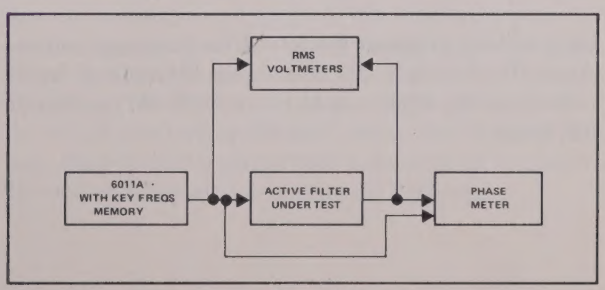

Figure 11

APPLICATION NOTE NUMBER 13

Production testing of pacemakers and hybrid filter circuits.

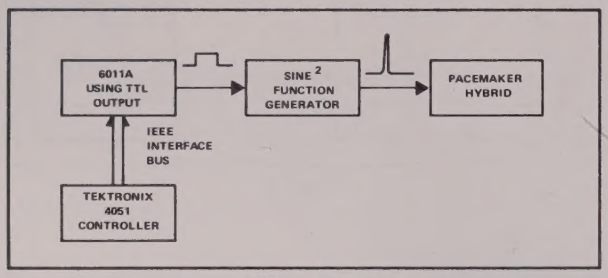

Figure 12

Under control of the Tektronix 4051, the 6011A is used to establish period or repetition rate for simulation of heart beat in testing of pacemaker hybrids. The 6011A TTL output drives a Dana/Exact function generator which outputs a sine squared function at the 6011A output frequency. This sine squared signal simulates a heart signal to test a pacemaker hybrid.

In the second application, the 6011A provides signals to hybrids for active high, low and band pass filter testing. The increment/decrement feature is utilized here to step through various specified frequencies under program control. Customer feels this is a great time saving feature for measurement of frequency response.

APPLICATION NOTE NUMBER 14

Programmable modulator for production test of RF module.

The block diagram shows a setup used for high speed production testing of RF modules. Three 6011As are required. The first unit programs the frequency selective voltmeter. A carrier frequency is generated by the second unit while the third unit modulates the carrier and alternately provides audio to the unit under test.

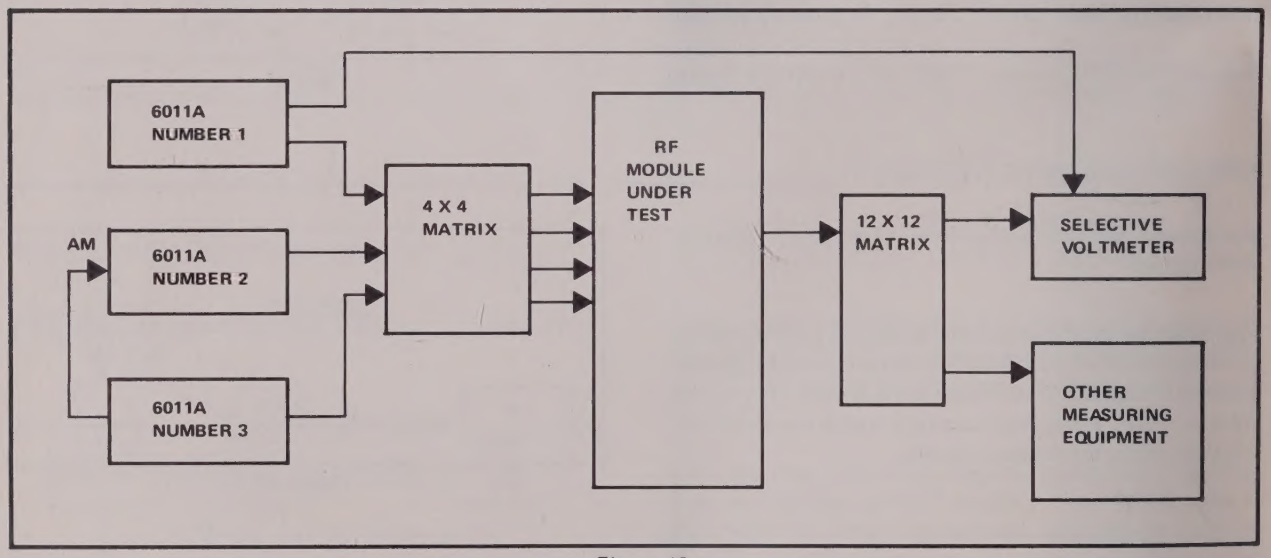

Figure 13

APPLICATION NOTE NUMBER 15

Calculator controlled programmable modulator for HP 8660.

The calculator programs the 6011A for frequency and amplitude. The 6011A output is fed to the FM input of the HP 8660. Resulting signal is used to test VHF-FM receivers for U.S. Army.

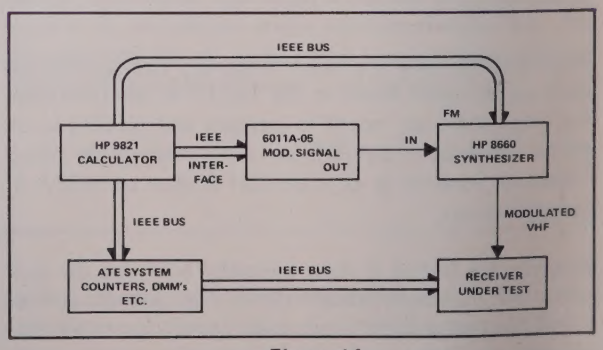

Figure 14

APPLICATION NOTE NUMBER 16

Testing of PCM receivers.

The test setup shown above provides checks for phase, harmonic distortion, gain, and linearity. 6011A Edit controls are used for both frequency and level. AM input is used with a sawtooth waveform. Stability of both amplitude and level are very important in this application. In fact, the customer stated that the 6011A's ability to set both frequency and level is better than any other piece of equipment he has seen.

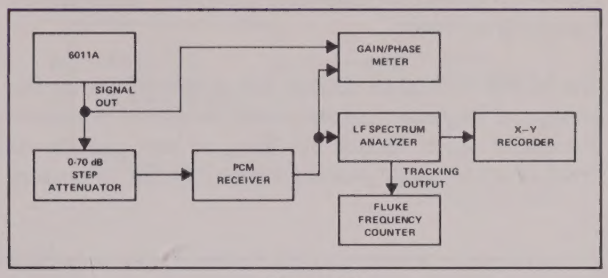

Figure 15

APPLICATION NOTE NUMBER 17

Spectral density testing of microwave systems.

This application involves a system designed to measure normalized power spectral density. A production test is required to measure both AM and FM noise relative to some predetermined threshold on a go-no-go basis. The 6011A will be used as a calibration source providing both AM and FM baseband signals in the range of 15 Hz to 200 kHz. A programmable calculator provides setup, checkout, and calibration routines. Wide frequency range and programmability were the main features which qualified the 6011A for this application.

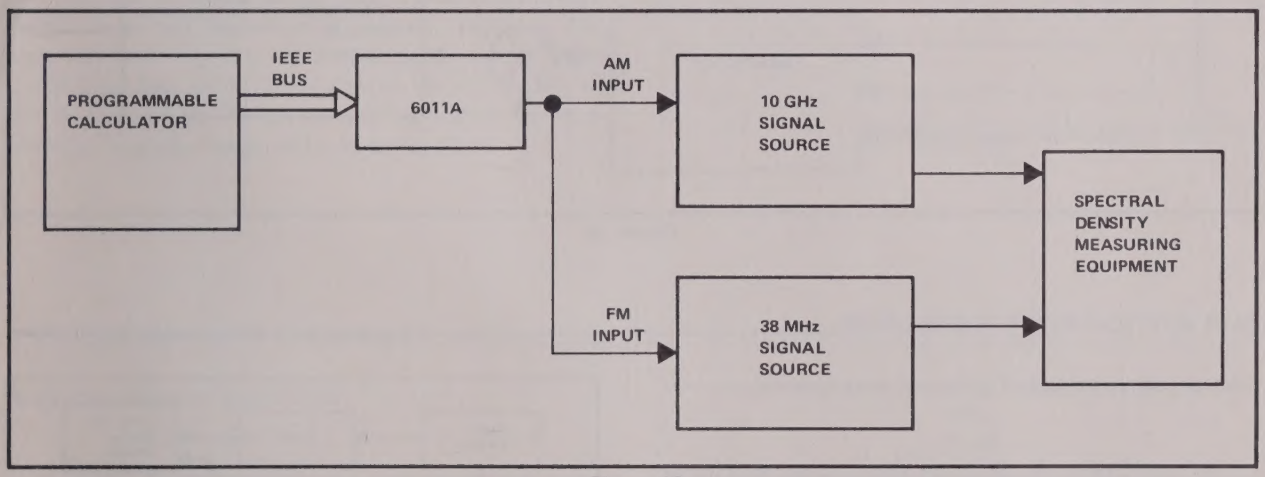

Figure 16

APPLICATION NOTE NUMBER 18

Signal processing from magnetic tape.

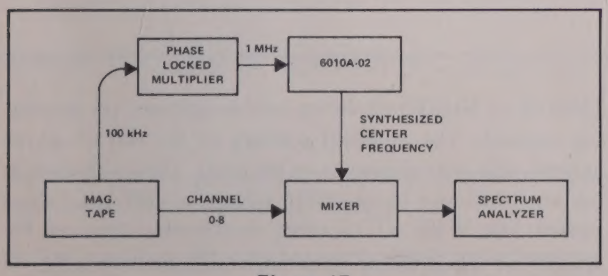

Figure 17

In this application, the 6010A is used to synthesize a reference frequency for comparison to the various recorded channel frequencies as follows: a 100 kHz tone is recorded on the magnetic tape. This tone is played back into a phase locked oscillator to generate a 1 MHz signal which is fed to the -02 option (phase lock) of the 6010A. The output of the 6010A provides synthesized center frequencies of the tape. Each channel is played back and compared in a mixer. The output is displayed on a spectrum analyzer.

APPLICATION NOTE NUMBER 19

Calibration system for transducer controllers which operate a gas dynamic laser.

The 6011A is used to quickly and accurately set up calibration of frequency and amplitude for various transducer controllers which control the firing of laser gases in the event of an excessive pressure buildup. By use of memory storage, preprogrammed frequency and amplitude values are called up to check out the system frequency filters and the transducer controller units to verify proper operation and feedback to the Computer Data Acquisition system. The various filters operate from 500 Hz to 5 kHz and 5 kHz to 16 kHz. Memory storage of both frequency and level information is important in this application.

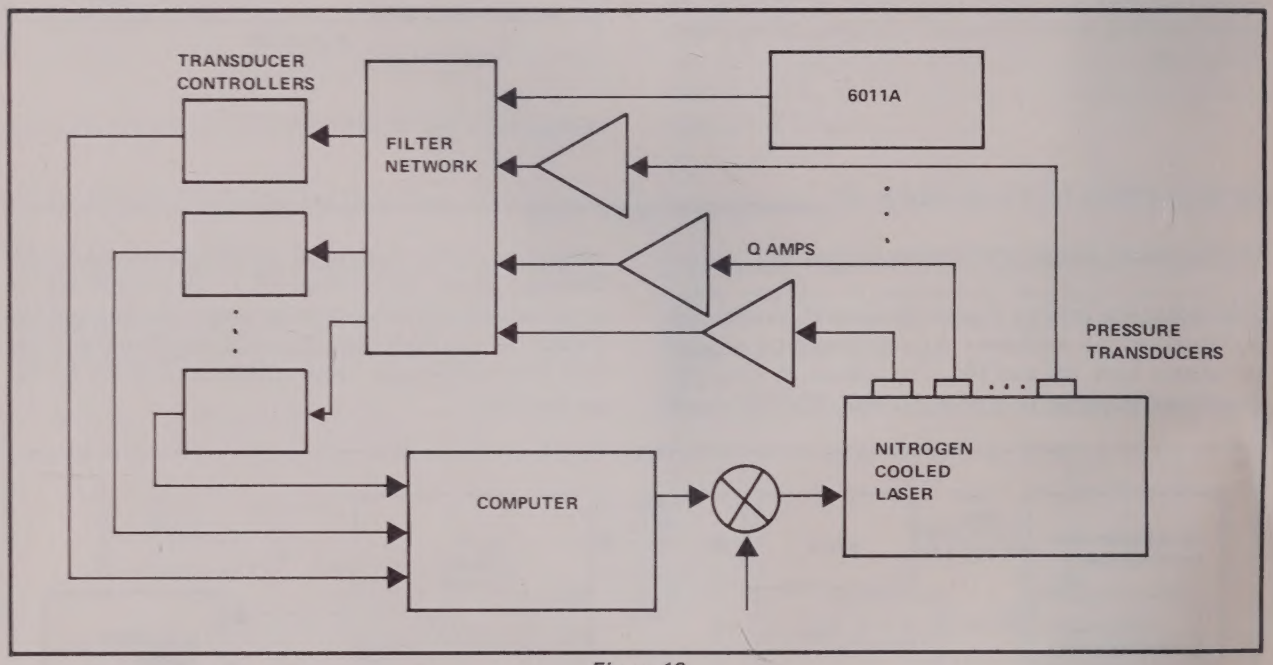

Figure 18

APPLICATION NOTE NUMBER 20

General purpose testing of gyros and servo systems.

In this application, the 6010A is phase locked to a house standard or system clock. The precise frequencies generated are used to develop gyro and servo systems. Storage is a handy feature here.

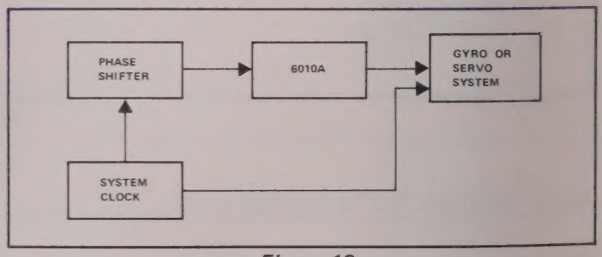

Figure 19

APPLICATION NOTE NUMBER 21

Calibration standard for an infrared detection system.

The output of a typical infrared detector must be processed through a complex filter and amplifier network to obtain a usable signal. In the application shown above, the 6011 is used to generate precise frequency and amplitude signals (500 Hz to 50 kHz) which are used to calibrate the processing network. The excellent stability of the 6011A allows precise drift measurements to be made. Data collection is accomplished by a Fluke 8800A voltmeter with data output option. Use of the 6011A saved considerable time over the previous setup which consisted of a HP oscillator and dB attenuator box.

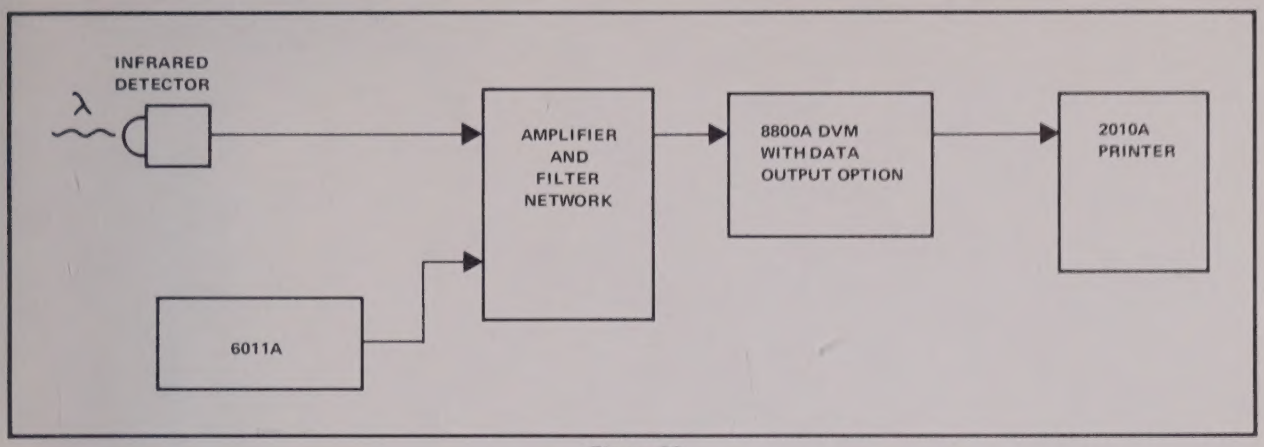

Figure 20

APPLICATION NOTE NUMBER 22

Production testing of hybrid AC to DC converters.

Test program is stored in the programmable calculator. Various levels and frequencies are called in sequence. The levels vary from 10mV to 2V with frequencies from 10 Hz to 100 kHz. Test records are printed on the printer. Important features of the 6011A in this application are level accuracy, frequency range, and programmability.

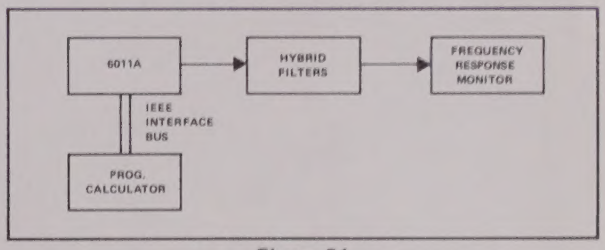

Figure 21

APPLICATION NOTE NUMBER 23

Production testing of crystal filters.

6010A with 75Ω output impedance is used in this application. Ten key frequencies are stored in memory. Production test operator recalls each in sequence described by test procedure. Low cost and simplicity of operation are the important features of 6010A in this application.

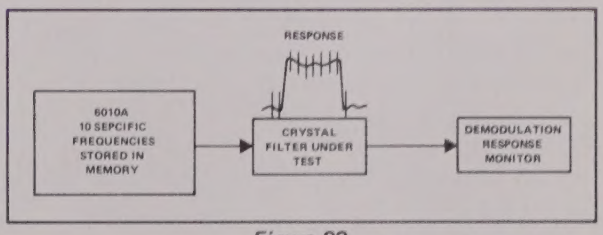

Figure 22

APPLICATION NOTE NUMBER 24

Local oscillator for precision dual conversion superhetrodyne receiver used for a position reporting system.

In this application, the 6010As are phase locked to a rubidium frequency standard. The system is a dual conversion superhetrodyne receiver with the 6010As acting as the converting oscillators. Frequencies are in the 6 - 7 MHz region. The system has a video display which gives the location of several military vehicles simultaneously. This application makes use of the 6010A's low noise and phase lock ability.

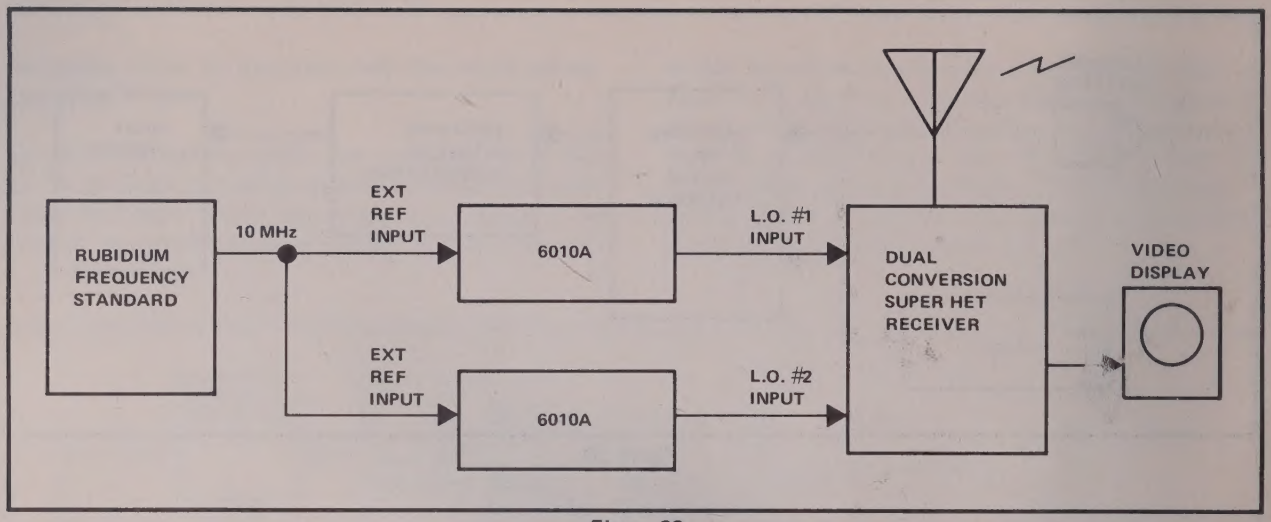

Figure 23

APPLICATION NOTE NUMBER 25

Signal source for calibration of cesium beam atomic frequency standards.

Calibration of the "C-field" in cesium beam frequency standard requires a precise frequency of 42.790 kHz. The 6010A replaces a Wavetek or HP oscillator and counter previously required for this operation. Frequency stability is important in this application.

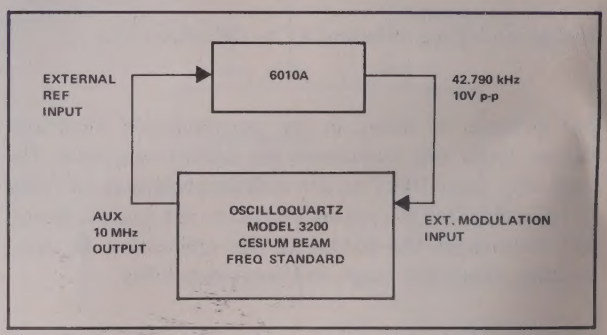

Figure 24

APPLICATION NOTE NUMBER 26

Automatic test system for testing wideband receivers.

Basic function of 6010A is to inject calibrated RF and IF signals on command from the computer. The 6011A is used alternately in CW and FM mode and is controlled in ASCII to provide signals below the HP 8660B lower limit of 10 MHz. Data indicating receiver sensitivity is digitized and fed to computer storage.

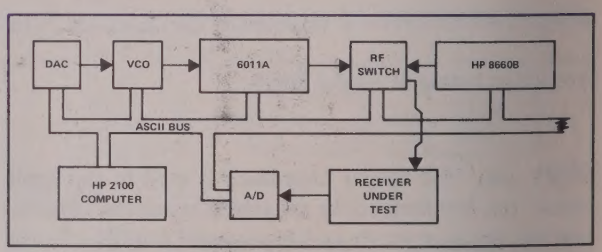

Figure 25

MP MASTER
MA30837

FLUKE®

John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043, Phone 206-774-2211
Fluke Nederland (B.V.), P.O. Box 5053, Zevenheuvelenweg 53, Tilburg, Netherlands, Phone 013-67-3973